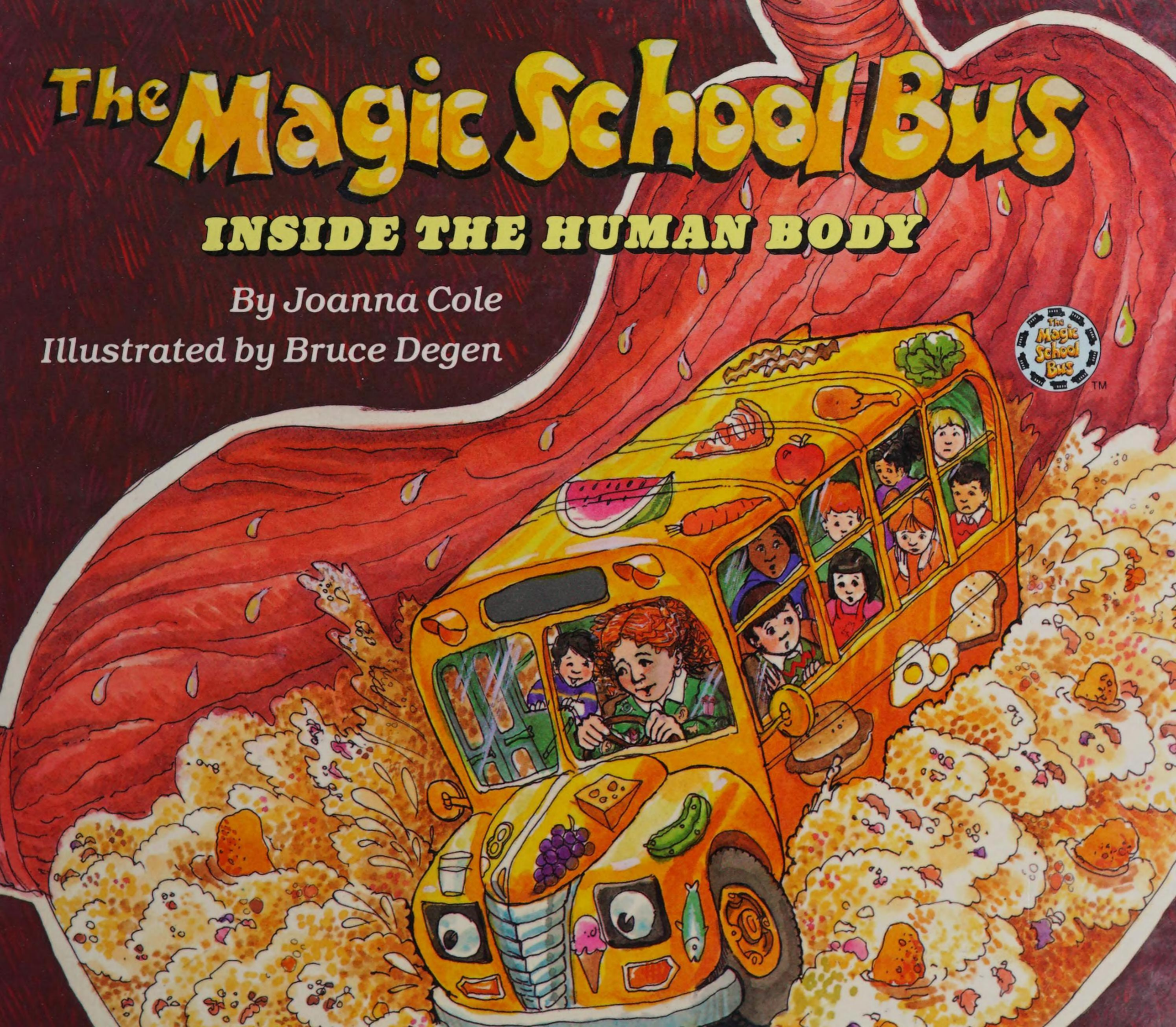
The Magic School Bus

INSIDE THE HUMAN BODY

By Joanna Cole

Illustrated by Bruce Degen



$13.95

Talk about a change of plans! Ms. Frizzle and her class are on the Magic School Bus headed for a museum. They have been studying how the body turns food into energy, and now they are going to see an exhibit on the human body. Things seem fine until they stop for lunch. A strange mishap causes the bus to shrink and then be *swallowed*! Ms. Frizzle's class is suddenly inside a *real* human body!

"I thought we were going to a museum," says one of the kids.

"There's been a slight change of plans..." announces the Friz. "We're being digested instead."

Yikes! Through the stomach and intestines, into the blood stream, the class travels to the heart, the lungs, the brain. How will they ever get out?

Fasten your seat belts! Joanna Cole and Bruce Degen have come up with another incredible trip on the Magic School Bus.

The Magic School Bus Inside the Human Body

By Joanna Cole Illustrated by Bruce Degen

SCHOLASTIC HARDCOVER

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To Craig
from Joanna
& Bruce

It all began when Ms. Frizzle showed our class a filmstrip about the human body.
We knew trouble was about to start, because we knew Ms. Frizzle was the strangest teacher in the school.

WE'RE GOING TO LEARN ABOUT OURSELVES. THIS SHOULD INTEREST YOU, ARNOLD!
MY FAVORITE HERBIVORE
MY FAVORITE CARNIVORE
I CAN'T TAKE THE PRESSURE!
MY FAVORI OMNIVORE

A FILMSTRIP IS ONLY THE BEGINNING, YOU KNOW.

YEAH! I BET SHE HAS Books ABOUT THIS, TOO.

WHEN'S RECESS?

YOUR WONDERFUL BODY

YOUR BODY IS MADE OF CELLS
by Rachel

Your body seems to be all one piece, but actually it is made of trillions of tiny pieces, called cells.

MY BODY IS MADE OF TRILLIONS OF CELLS.

SO IS MINE!

The very next day, The Friz made us do an experiment on our own bodies.

SEE YOUR OWN CELLS

Most cells are so small that we can't see them without a microscope.

① Gently scrape inside of cheek with toothpick

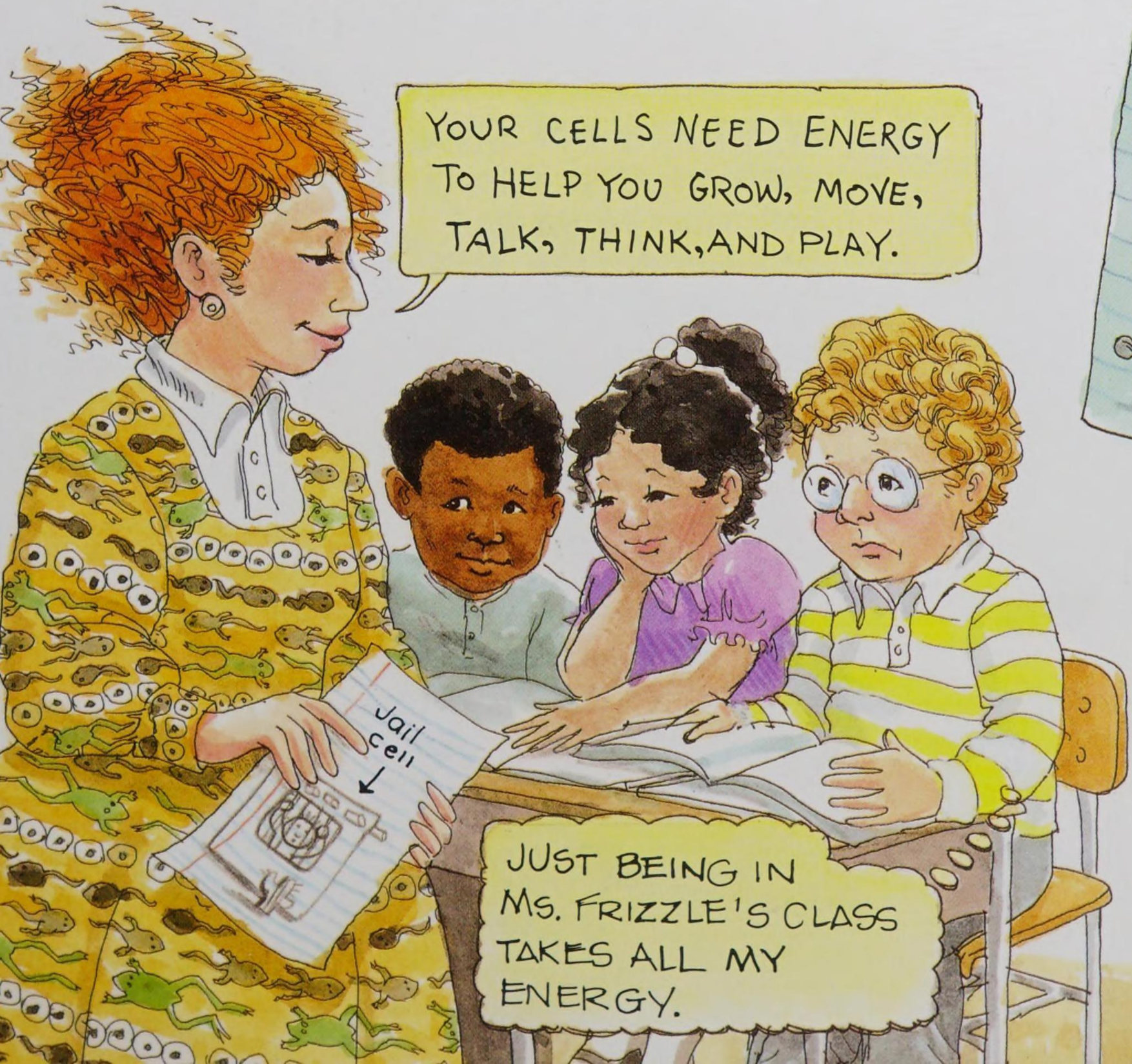
② Stir end of toothpick in drop of water on a slide.

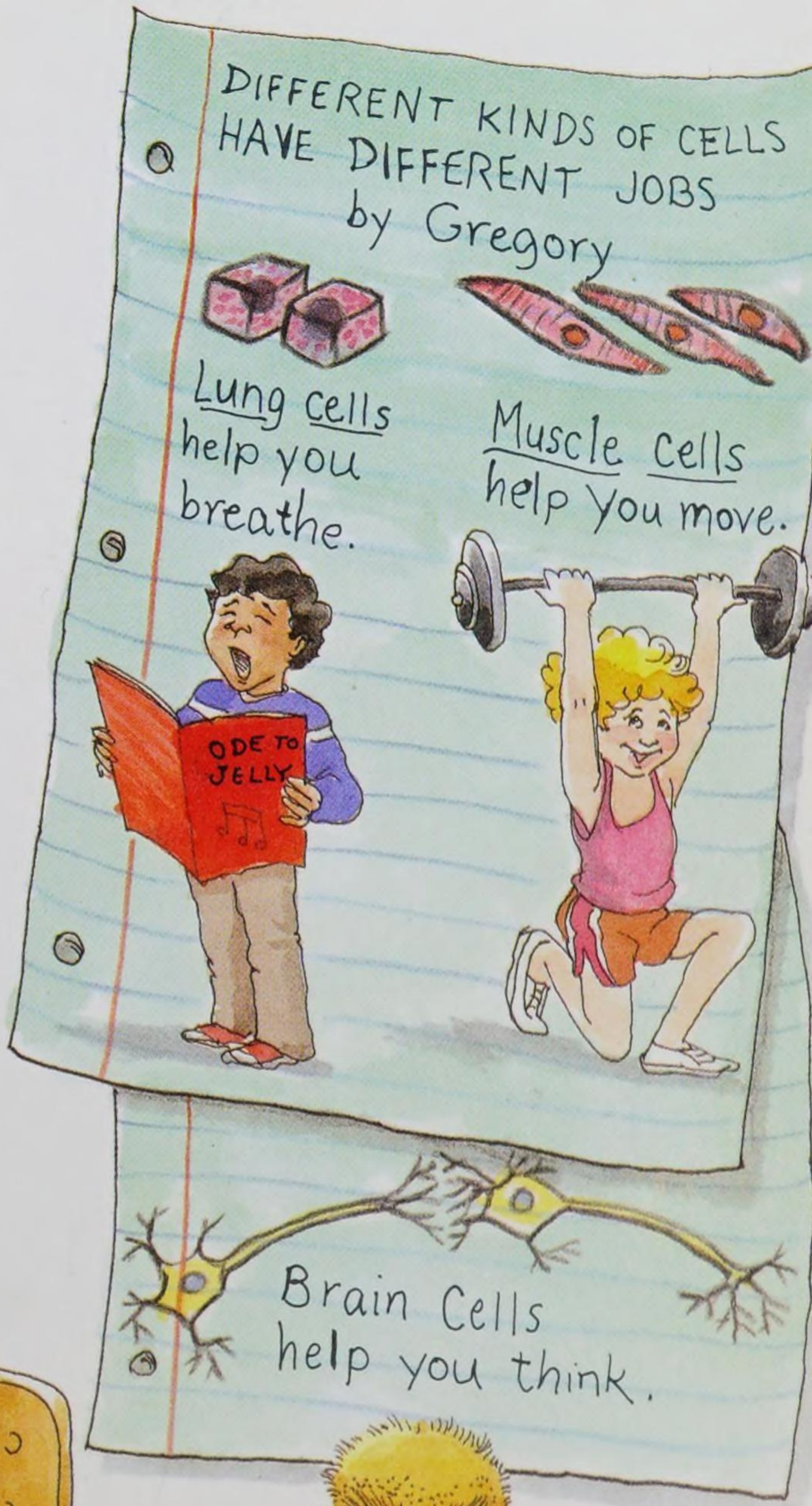
③ Add a drop of Iodine Solution to color cells.

④ Look at slide under microscope. See Your cells.

OOOH, WEIRD!

Then she announced that we were going on a class trip to the science museum. We were going to see an exhibit about how our bodies get energy from the food we eat.

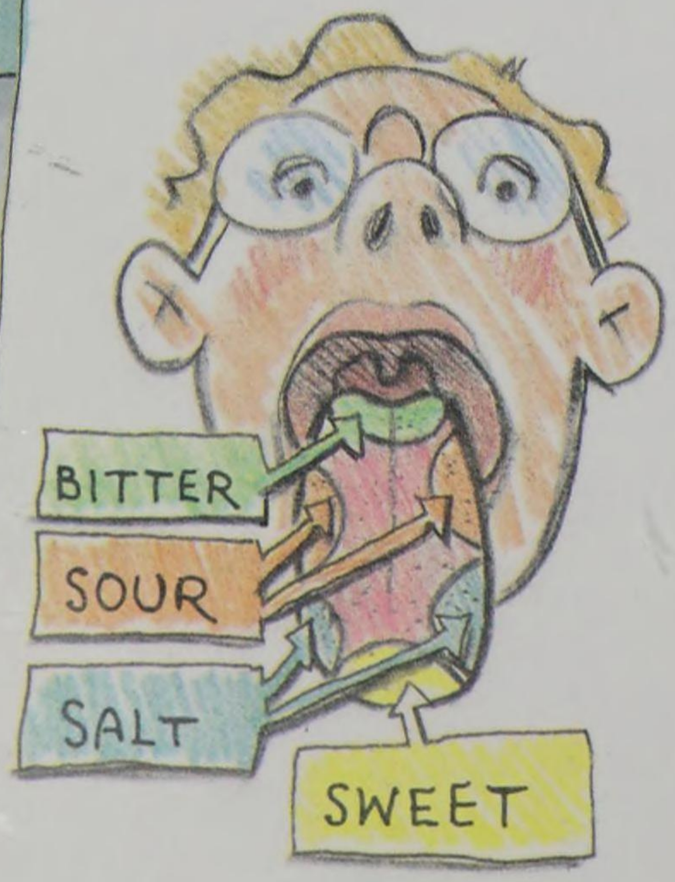

YOUR CELLS NEED ENERGY TO HELP YOU GROW, MOVE, TALK, THINK, AND PLAY.
Jail cell
JUST BEING IN MS. FRIZZLE'S CLASS TAKES ALL MY ENERGY.


DIFFERENT KINDS OF CELLS HAVE DIFFERENT JOBS
by Gregory
Lung cells help you breathe.
Muscle cells help you move.
ODE TO JELLY
Brain Cells help you think.

YOUR TONGUE IS COVERED WITH THOUSANDS OF TASTE BUDS

by Arnold

Different parts of the tongue have taste buds that detect different flavors.



The trip started out like any other trip.
We rode to the museum
in the old school bus.
Along the way,
we stopped at a park for lunch.

LEFT OVER FISH STICKS?! ICK!

I'LL TRADE YOU THESE TERRIFIC FISH STICKS FOR THAT HORRIBLE PEANUT BUTTER AND BANANA SANDWICH.

FORGET IT!

TAKE A LOOK AT HER SHOES.

PLEASE! I'M EATING!

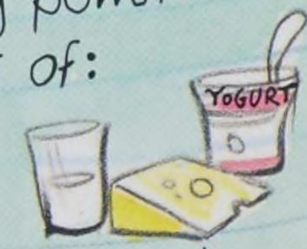
When it was time to go,
everyone got back on the bus—
everyone but Arnold.
He was still at the picnic table,
daydreaming and eating
a bag of Cheesie-Weesies.

WHEN YOU EAT, YOUR BODY DIGESTS THE FOOD SO YOUR CELLS CAN USE IT TO MAKE ENERGY.

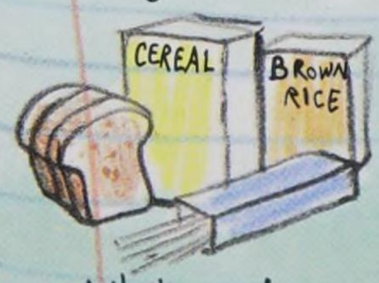
YOUR BODY NEEDS GOOD FOOD
by Carmen

For high energy and good growing power eat lots of:

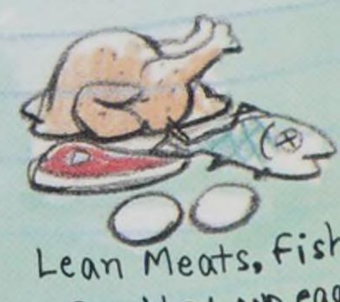
Fresh fruits and Vegetables



Milk and Milk products



Whole grain cereal and Pasta

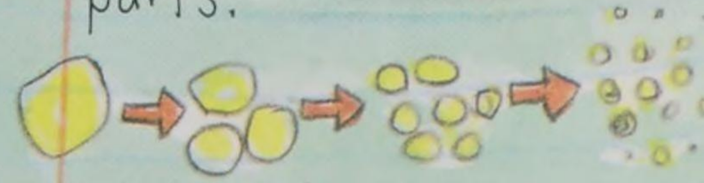


Lean Meats, Fish Poultry, AND eg

AND NOT TOO MUCH JUNK FOO

A SCIENCE WORD
by Dorothy Ann

Digestion comes from a word that means to divide. When food is digested it is divided into smaller and smalle parts.

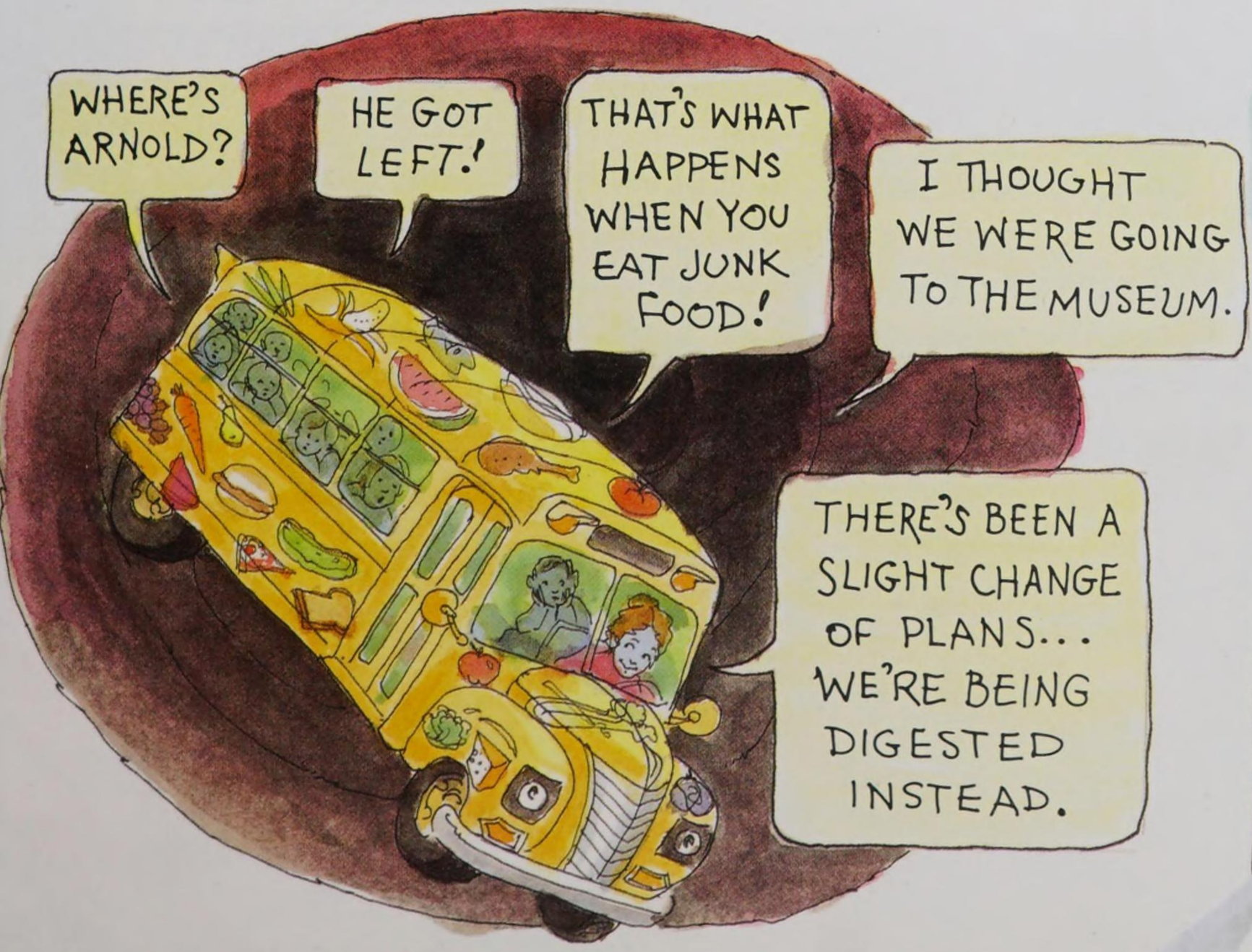


"Hurry up, Arnold!" called Ms. Frizzle. She reached for the ignition key, but instead she pushed a strange little button nearby.

At once, we started shrinking and spinning through the air.

From inside, we couldn't see what was happening. All we knew was that we landed suddenly...

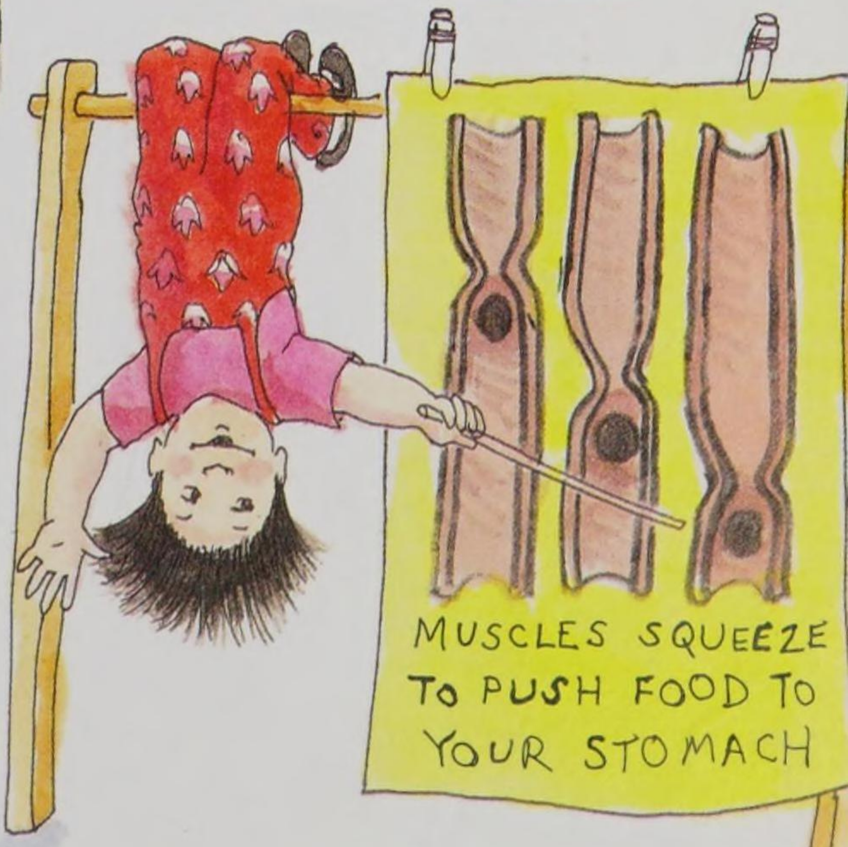
and then we were going down a dark tunnel.
We had no idea where we were.
But, as usual, Ms. Frizzle knew.
She said we were inside a human body,
going down the esophagus—
the tube that leads from the throat
to the stomach.
Most of us were too upset
about leaving Arnold behind
to pay much attention.


WHERE'S ARNOLD?
HE GOT LEFT!
THAT'S WHAT HAPPENS WHEN YOU EAT JUNK FOOD!
I THOUGHT WE WERE GOING TO THE MUSEUM.
THERE'S BEEN A SLIGHT CHANGE OF PLANS... WE'RE BEING DIGESTED INSTEAD.

FOOD GOES TO YOUR STOMACH THROUGH THE ESOPHAGUS

by Wanda

The food does not just fall down. It is pushed along by muscle actions the way toothpaste is squeezed out of a tube. That's why you can swallow even when you are upside down.



WHY DOES YOUR STOMACH GROWL?
by Phil
Sometimes your stomach churns when there is not much food in it. Then the gases in your stomach make a gurgling sound.

"We are now passing into the stomach," said Ms. Frizzle.
It wasn't exactly *quiet* in there.
The walls of the stomach moved in and out, churning and mashing the food into a thick liquid.
The bus was turning round and round, and digestive juice splashed the windows.
Now we knew how it felt to be a hamburger!

YOUR STOMACH IS LIKE A BUILT-IN FOOD PROCESSOR.

GURGLE!

ROLL UP YOUR WINDOWS, CHILDREN.

YUCK!

Ms. Frizzle drove to the bottom of the stomach.
"We'll drive through this opening to the small intestine," she said.

IN THE SMALL INTESTINE, FOOD IS BROKEN DOWN INTO MOLECULES TINY ENOUGH FOR THE BODY CELLS TO USE.

I WANNA GO HOME!

BUT THIS IS EDUCATIONAL.

DOES EDUCATION HAVE TO BE THIS MESSY?

I DON'T FEEL SO GOOD. MAYBE IT WAS SOMETHING I ATE.

POOR KID!

WHY ARE THE INTESTINES COILED UP?

by John

In an adult the intestines are 7.5 meters (25 feet) long. If they were stretched out straight, a person would have to be as tall as a house.

STOMACH

FOOD GOES FROM THE STOMACH TO THE SMALL INTESTINE

WASTE GOES OUT THROUGH THE LARGE INTESTINE

The small intestine was
a coiled-up hollow tube.
The inner walls of the tube were covered
with tiny "fingers" called *villi*.
"In the *villi* are tiny blood vessels.
Food molecules are taken into
these blood vessels,"
said Ms. Frizzle.
"Once the food is in the blood,
it can travel all over the body."

We felt ourselves getting even smaller,
and Ms. Frizzle started driving
into one of the *villi*.
She was going straight into a blood vessel!

CLASS, THE BUS IS FOLLOWING THE PATH OF THE FOOD MOLECULES INTO THE BLOOD.

YOU MEAN THIS BODY THINKS WE'RE FOOD?

THAT'S BETTER THAN BEING WASTE.

I WISH ARNOLD WERE HERE TO SEE THIS.

YEAH! IT'S SO GROSS!

ANOTHER SCIENCE WORD
by Dorothy Ann

Blood Vessels are tubes that carry blood. They are like pipelines running through your body.

WHAT IS BLOOD MADE OF?
by Molly
A little more than half the blood is a yellowish fluid called PLASMA.
The rest of the blood is made of floating cells.

PLASMA
BLOOD CELLS
250,000,000

WHY IS BLOOD RED?
by Shirley
Without a microscope, blood looks red because there are so many red blood cells in it!
In every drop of blood there are 250 million red blood cells.

Now we were in the blood,
but it did not look red.
"Blood is not just a red liquid,"
explained Ms. Frizzle.
"Blood is made of cells,
floating in a clear fluid."
"Those cells look like red rubber saucers!"
someone called out.
"Those are red blood cells," Ms. Frizzle said.
"Red blood cells carry oxygen from the lungs
to all the cells of the body."

DID YOU SEE THAT?

RED BLOOD CELLS CARRY OXYGEN

FOOD MOLECULES

1 2

WHITE BLOOD CELLS

Here and there a white blood cell was busy destroying disease germs. "White blood cells are like soldiers protecting your body from enemies," said Ms. Frizzle.

THE WHITE BLOOD CELL ATE THE GERM.

THAT'S DISGUSTING!

PLATELET CELLS (HELP STOP BLEEDING WHEN YOU GET A CUT)

WHAT IS BLOOD FOR?
by Ralph
Your blood is like a delivery service. It carries food and oxygen to your body's cells and waste products away from the cells.

DISEASE GERMS

Looking back, we saw a white blood cell
chasing the bus.
"We'll be safer with the red blood cells, kids,"
said Ms. Frizzle.
She reached for the handle
that controlled the bus's doors.
"Don't do it!" we cried,
but when did Ms. Frizzle ever listen?
The doors of the bus flew open.

We were swept out of the bus
and into the bloodstream.
"Everybody hitch a ride!" called The Friz.
Each kid grabbed a red blood cell
as it went by.
Our last glimpse of the bus
was when it went into another blood vessel—
with the white blood cell right behind it!

WHY CAN'T WE JUST HAVE SPELLING TESTS LIKE OTHER KIDS?

WE'LL NEVER GET OUT OF HERE NOW!

THESE RED BLOOD CELLS HAVE TURNED DULL RED – THEY NEED MORE OXYGEN.

MEANWHILE...

OH MY GOSH! I'M LOST!

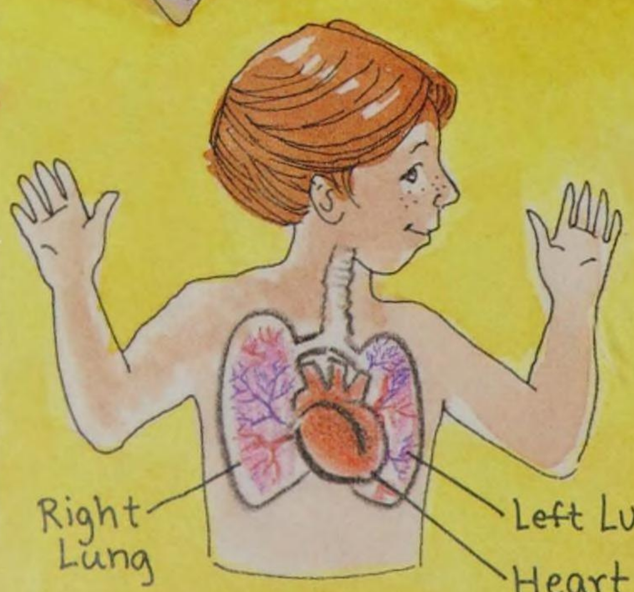
DON'T PANIC

YOUR HEART IS A PUMP
by Florrie

When the walls of the heart chambers squeeze together they pump out blood, just the way you can squeeze water out of a plastic squeeze bottle.

OOPS!

HEY!



YOUR HEART PUMPS USED BLOOD INTO THE LUNGS TO GET FRESH OXYGEN.

RIGHT LUNG

The next thing we knew, we had flowed into the heart.
"Inside the heart are four hollow spaces, called *chambers*," said Ms. F.
"Each chamber is a little pump."
The two chambers on the right side of the heart took in used blood from the body and pumped it to the lungs.

TO THE RIGHT LUNG

USED BLOOD FROM UPPER BODY

1st CHAMBER

HAVE A HEART, MS. FRIZZLE, GET US OUT OF HERE!

USED BLOOD FROM LOWER BODY

2nd CHAMBER

In the lungs, the red cells picked up fresh oxygen.

WE GET NEW OXYGEN FROM THE AIR EACH TIME WE BREATHE IN.

WE GET RID OF A WASTE GAS—CARBON DIOXIDE—EACH TIME WE BREATHE OUT.

TO THE LEFT LUNG

AIR SAC

NEW OXYGEN

CARBON DIOXIDE

LEFT LUNG

MY HEART IS POUNDING.

TAKE A DEEP BREATH. YOU'LL BE OK.

BLOOD GOES ROUND AND ROUND
by Michael
In less than a minute your blood makes a trip all around your body. This is called the circulation of the blood.

ONE MORE SCIENCE WORD
by Dorothy Ann
Circulate comes from a word that means "to circle". Blood circulates - circles - all around your body.

From the lungs, our red blood cells carried us back to the heart. This time we were on the left side of the heart—the side that pumps fresh blood back to the body again.
"Kids, it looks as if these red blood cells are on their way to the brain," said Ms. Frizzle.

LOOK! WHEN THE RED BLOOD CELLS PICK UP OXYGEN, THEY TURN BRIGHT RED.

FROM RIGHT LUNG

AIR SAC

CLASS, THOSE BRAIN CELLS NEED MORE OXYGEN!

WE'LL NEVER GET HOME UNLESS WE FIND THE BUS.

MAYBE WE'LL FIND IT IN THE BRAIN.

FRESH BLOOD TO UPPER BODY

FROM LEFT LUNG

3rd Chamber

4th Chamber

FRESH BLOOD TO LOWER BODY

WHICH WAY BACK TO SCHOOL?

USE YOUR BRAIN.

YOUR BRAIN IS ALWAYS WORKING
by Alex
Even when you're sleeping, your brain controls your heartbeat, breathing, and other body functions.

When we reached the brain, we let go of our red blood cells and squeezed out of the blood vessel. It was hard to believe that this wrinkled gray blob was the control center of the body.

CHILDREN, WE ARE WALKING ON THE CEREBRAL CORTEX, THE PINKISH GRAY, OUTER LAYER OF THE BRAIN. WITHOUT IT WE COULDN'T SEE, HEAR, SMELL, TOUCH, TASTE, TALK, MOVE, OR THINK!

MOTOR CENTER
TELLS MUSCLES TO

SPEECH CENTER

HEARING CENTER

YOUR BRAIN NEVER LIES DOWN ON THE JOB.

3:00 A.M. and still at it.

CEREBRAL CORTEX
Controls thinking, moving and the five Senses.

Ms. Frizzle said
the brain is made of
billions of busy nerve cells.
They are constantly sending
and receiving messages
from the eyes, ears, muscles,
and other parts of the body.

TOUCH CENTER

WHERE'S THE BUS?

DO YOU THINK WE'LL BE SMARTER AFTER THIS?

I HOPE SO!

VISION CENTER

CEREBELLUM:
Helps you keep your balance, Helps muscles work together.

BRAIN STEM:
Controls body functions like heartbeat and breathing.

LET'S SEE... MS. FRIZZLE WAS DRIVING THAT WAY TO THE MUSEUM, SO OUR SCHOOL MUST BE THIS WAY.

GOOD THINKING.

IF YOU WANT TO MOVE A MUSCLE
by Amanda Jane

The motor area (in the cortex) of your brain sends out a message to move. The message travels down the spinal cord and through the nerves that control the muscles.

We left the head by climbing down the bones of the spine.
Inside the bones was the spinal cord—a thick bundle of nerve cells stretching from the brain.
Smaller bundles of nerve cells branched out from each side of the spinal cord.
These carried nerve messages to all the parts of the body.

THE SPINAL CORD CONNECTS THE BRAIN WITH THE NERVES THAT GO TO THE BODY.

DON'T LOOK DOWN!

MOTOR AREA

HEY! THAT TICKLES!

SPINAL CORD

NERVES

MUSCLES

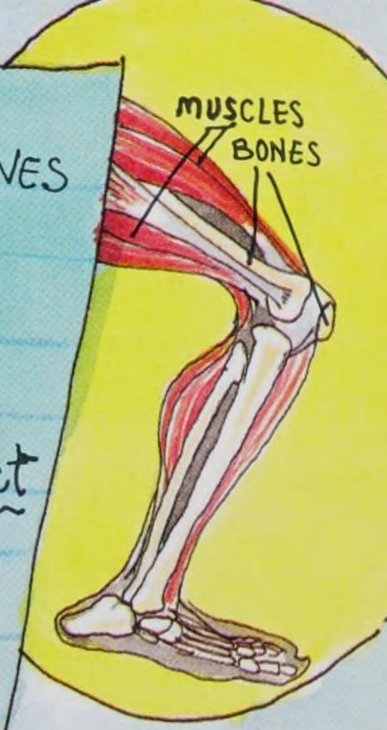
SPINAL CORD

I THINK I'M LOSING MY NERVE!

NERVE BUNDLE

We followed some nerves that went
to the leg muscles.
The leg muscles were working hard.
They needed a lot of energy.
They used up a lot of food and
oxygen from the blood.
The heart was beating faster to carry
fresh blood to the muscle cells.

MUSCLES MOVE YOUR BONES
by Tim
Some muscles are attached to bones. When the muscles contract (get shorter) they pull on the bones. That makes the bones move, and then you move.



CHILDREN, WE ARE SLIDING ON A MUSCLE. FROM HERE, WE'LL RETURN TO THE BLOODSTREAM.

NERVE ENDING

MUSCLE FIBER

I WONDER WHERE ARNOLD IS NOW.

I HAVE THE STRANGEST FEELING HE'S CLOSE BY.

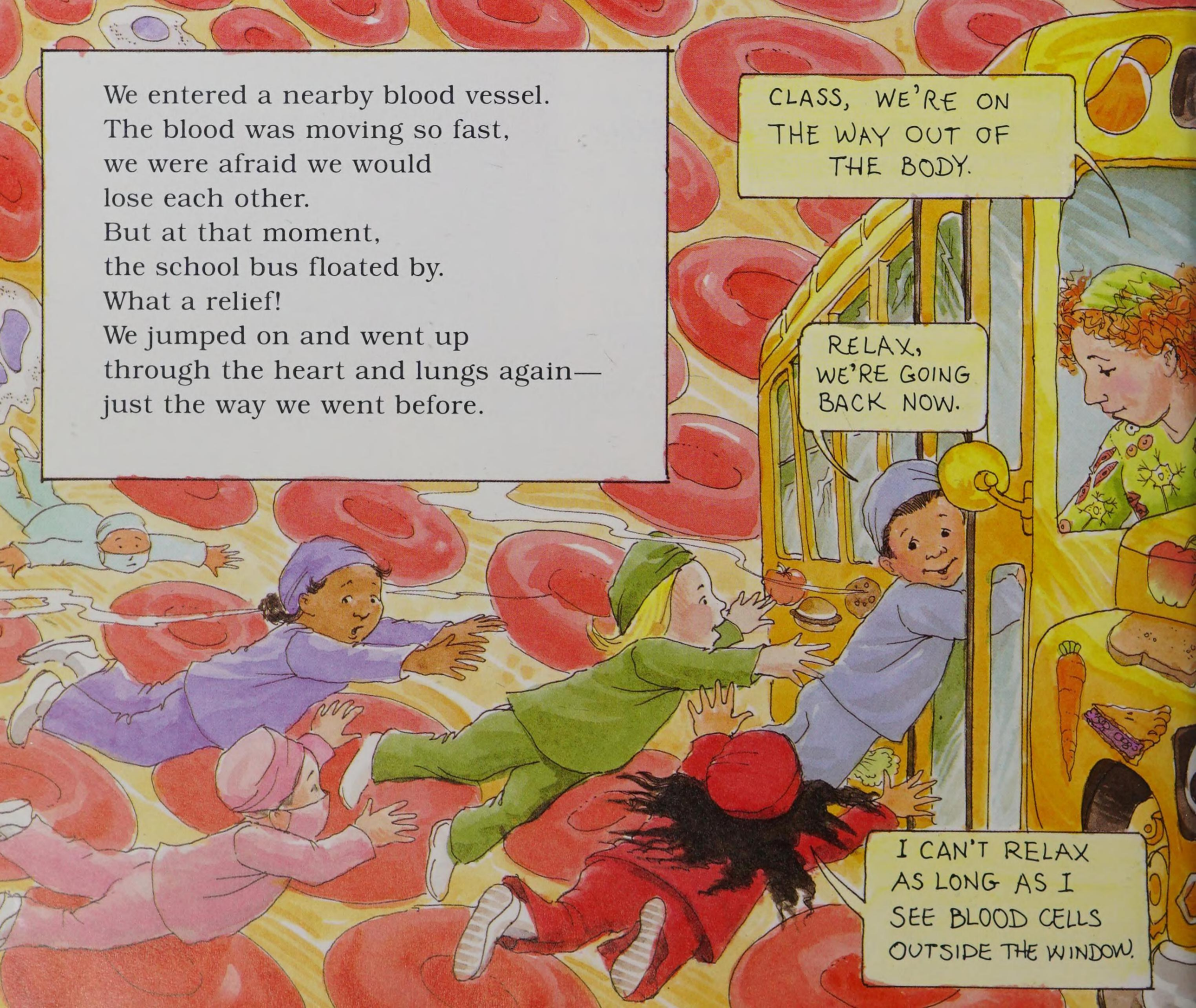
BLOOD VESSEL

I'LL GET THERE SOONER IF I RUN! (PANT! PANT!)

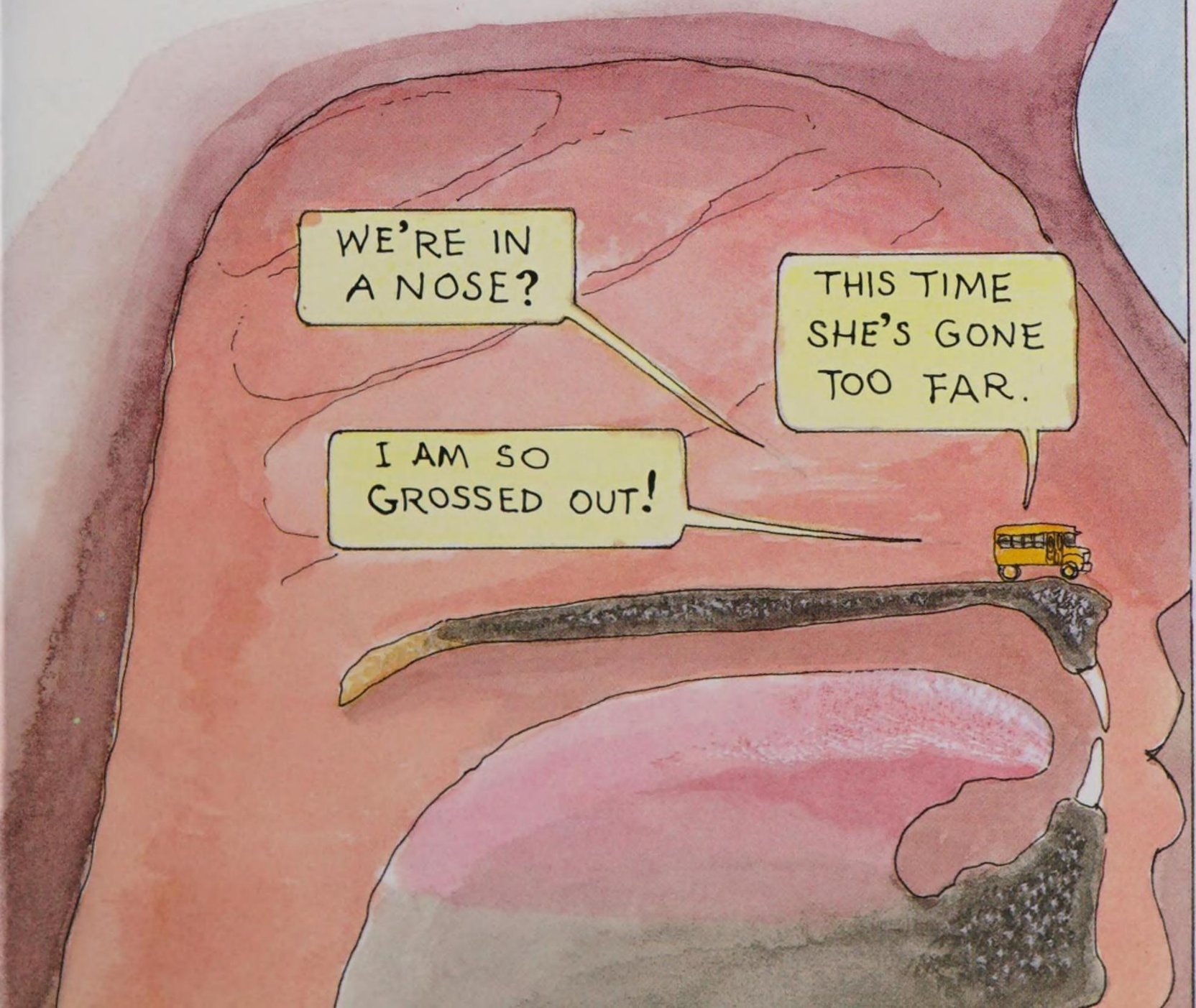
THUMP THUMP

THE MORE ACTIVE YOU ARE THE FASTER YOUR HEART BEATS.

We entered a nearby blood vessel.
The blood was moving so fast,
we were afraid we would
lose each other.
But at that moment,
the school bus floated by.
What a relief!
We jumped on and went up
through the heart and lungs again—
just the way we went before.



When we emerged from the bloodsteam,
we were in a huge open space.
"Where are we?" asked a kid.
Ms. Frizzle explained,
"Children, this is the nasal cavity."
"The what?" we asked.
"The inside of the nose," said The Friz.
Suddenly, we heard a deafening noise.
It sounded like "Ah-aa-aa-ah!"



WHAT MAKES YOU SNEEZE?
by Phoebe

If something is tickling the inside of your nose, the tickling signals your brain.

The brain makes you take an extra big breath. (That's when you say Aaah!)

Then your brain makes your chest muscles squeeze your lungs.

Air rushes out at speeds of up to 100 miles per hour. (Thats when you say choo!)

Then we heard, "CHOOOOOO!"

CLASS, THE SOUND YOU HEAR IS A SNEEZE.

ANYTHING IN THE NOSE CAN MAKE YOU SNEEZE. IT COULD BE A BIT OF DIRT OR DUST, OR SOME BACTERIA.

IN THIS CASE IT HAPPENS TO BE A SCHOOL BUS.

A tremendous blast of air
hit the bus full force.
We flew forward,
spinning around and around.

CHILDREN, PREPARE FOR LANDING. PLEASE REMAIN SEATED UNTIL THE SCHOOL BUS HAS COME TO A COMPLETE STOP.

IS SHE FOR REAL?

A-A-A-AH CHOO!

GESUNDHEIT!

We were going so fast,
we couldn't see anything,
but we could tell we were getting bigger.
Then—thud!—we landed.
There we were, back at school.
And there was Arnold,
in the school parking lot,
blowing his nose.

"Arnold!" we said, "the trip was *amazing!*
You should have been there!"

Back in the classroom,
it was business as usual.
Ms. Frizzle made us draw
a chart of the human body
for the bulletin board.

THE KIDNEYS CLEAN YOUR BLOOD AND MAKE URINE.

THE BLADDER STORES URINE.

IDNEYS

BLADDER

LIVER

STOMACH

THE LIVER STORES VITAMINS AND DESTROYS POISONS. IT ALSO MAKES BILE, A FLUID THAT HELPS DIGEST FATTY FOODS.

NERVE

BLOOD VESSEL

BONE

MUSCLE

CAN WE SLIP THESE KIDNEYS IN BEHIND THE INTESTINES?

KIDNEYS? LIVER? I GUESS WE DIDN'T HAVE TIME TO GO THERE.

THANK GOODNESS.

THE HUMAN BO

GALL BLADDER
LIVER
LUNGS
WINDPIPE
NOSE
BRAIN
SPINE
ESOPHAGUS
HEART
STOMACH
SMALL INTESTINE
LARGE

WHAT A TRIP!

I'D LIKE TO GO TO THE LUNGS AGAIN.

I'D RATHER GO TO HAWAII.

BRAIN
NOSE
SPINE
ESOPHAGUS
WINDPIPE
LUNGS
HEART
LIVER
STOMAC

HEY!

THE HEART

At last, everything was quiet in Ms. Frizzle's class—everything, of course, except her dress!

SHE MUST BUY HER CLOTHES IN OUTER SPACE.

DON'T GIVE HER ANY IDEAS!

OUR SOLAR SYSTEM

YOU ARE HERE

SUN

RED BLOOD CELLS ARE CUTE!

by Molly

My favorite Organ by Arnold

A FULL STOMACH.

My Favorite Organ by Carmen

THE NOSE

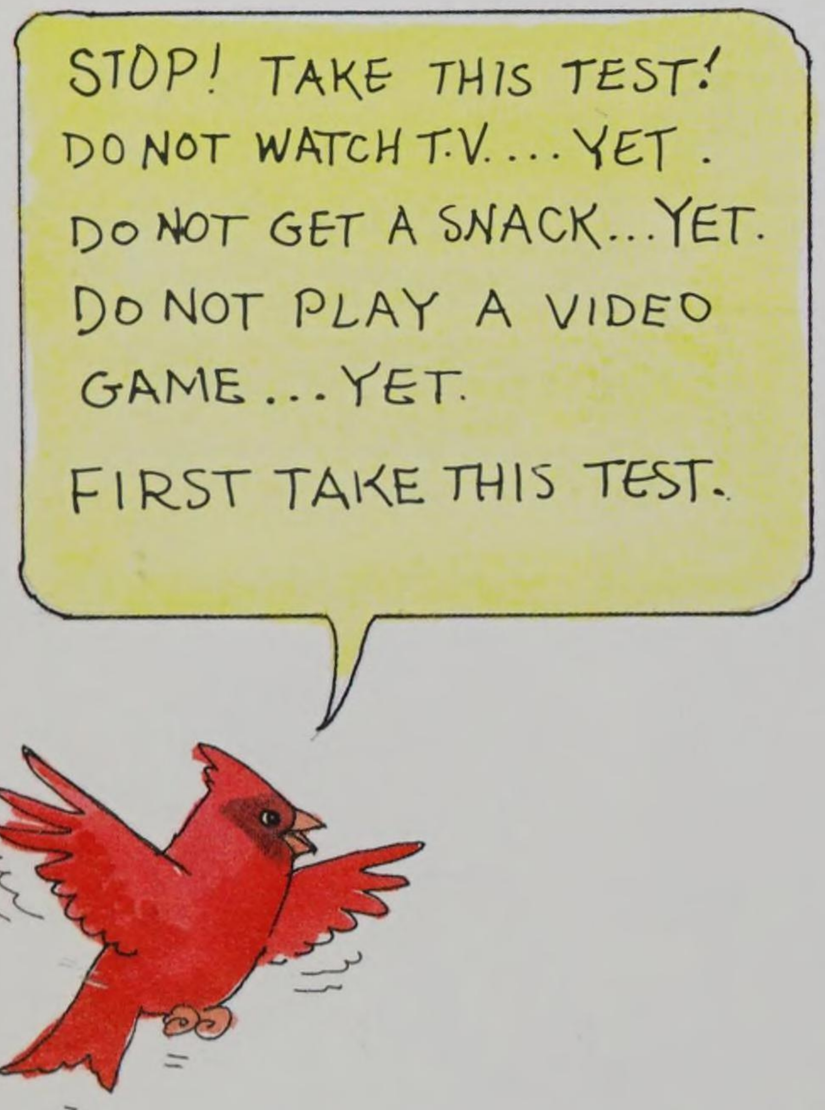
It's a Front-runner

I ♡ MY EARS by WANDA

MY LUNGS

KEEP THEM CLEAN

by Tim



TRUE-OR-FALSE TEST

HOW TO:
Read the sentences below. Decide if each one is true or false. To see if you are correct, check the answers on the opposite page.

QUESTIONS:

1. A school bus can enter someone's body and kids can go on a tour. True or false?

2. Museums are boring. True or false?

3. Arnold should not have tried to get back to school by himself. True or false?

4. Children cannot breathe or talk when they are surrounded by a liquid. True or false?

5. If the children really were as small as cells, we couldn't see them without a microscope. True or false?

6. White blood cells actually chase and destroy disease germs. True or false?

7. Ms. Frizzle really knew where Arnold was the whole time. True or false?

ANSWERS:

1. False! That could not happen in real life. (Not even to Arnold.)

But in this story the author had to make it happen. Otherwise, the book would have been about a trip to a museum, instead of a trip through the body.

2. False! Museums are interesting and fun. But they are not as weird and gross as actually going inside a human body.

3. True! In real life, it would have been safer if Arnold had found a police officer to help.

4. True. If children were *really* inside a blood vessel, they would drown. It must have been magic.

5. True! The pictures in this book show the cells and the children greatly enlarged.

6. True! As unbelievable as it seems, real white blood cells actually behave just like the ones in this book. They even squeeze through the cells of blood vessel walls to capture germs in your organs and tissues.

7. Probably true. No one is absolutely sure, but most people think Ms. Frizzle knows *everything*.

SUPPLY
CLOSET

Both **Joanna Cole** and **Bruce Degen** loved science when they were in elementary school. So it's no wonder this talented pair enjoys collaborating on the Magic School Bus science series. What is surprising is that neither of them ever rode a school bus. They both walked to school, Joanna to Columbia Grammar School in East Orange, New Jersey, and Bruce to P.S. 156 in Brooklyn, New York.

Then again, maybe it was all that walking that made school buses seem magic to Bruce and Joanna.

Don't miss these other exciting Magic School Bus adventures by Joanna Cole and Bruce Degen:

THE MAGIC SCHOOL BUS AT THE WATERWORKS
THE MAGIC SCHOOL BUS INSIDE THE EARTH

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